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Life of composite bridges

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Fatigue life assessment of said bridges can be based on fully probabilistic philosophy. The loading just as response history should be taken into account and a fatigue criterion based on the amplitude interpretation should be used. Design of structures issues from the requirements that a structural system has to fulfill. The part of great importance of this process is reliability assessment of the structure in question. Reliability means the ability of a structure to maintain qualities required in the course of the life-time appointed.

Up to now, the talking points have been solved e.g. in [3], [4] and [1], regarding the computational equipment in [2]. Failure represents a required property loss. It is possible to divide the reliability assessment into two parts. According to the limit state philosophy both loading effects and resistance of structures are investigated. And further we analyze an interaction of these two quantities.

The structure is reliable, if probability is very small, that load effects are greater than resistance of the structure. For reliability assessment it is necessary to consider rheological material properties, geometrical and material imperfections, and degradation factors et cetera. In the subjects of civil and mechanical engineering, fatigue is one of the most important limit state. In the reliability condition, it is possible to compare the state quantity with the limit value, namely by two methods.

The principle of reliability assessment concepts for a structure is indicated in Fig. 1, [2], in version (i) deterministic approaches – allowable stress design; (ii) partial factors design; (iii) fully probabilistic SBRA method.

These reliability evaluations are demonstrated in 2D (*R*, *S*) where *R* means resistance of a structure, *S* load effect, *NB* design point.

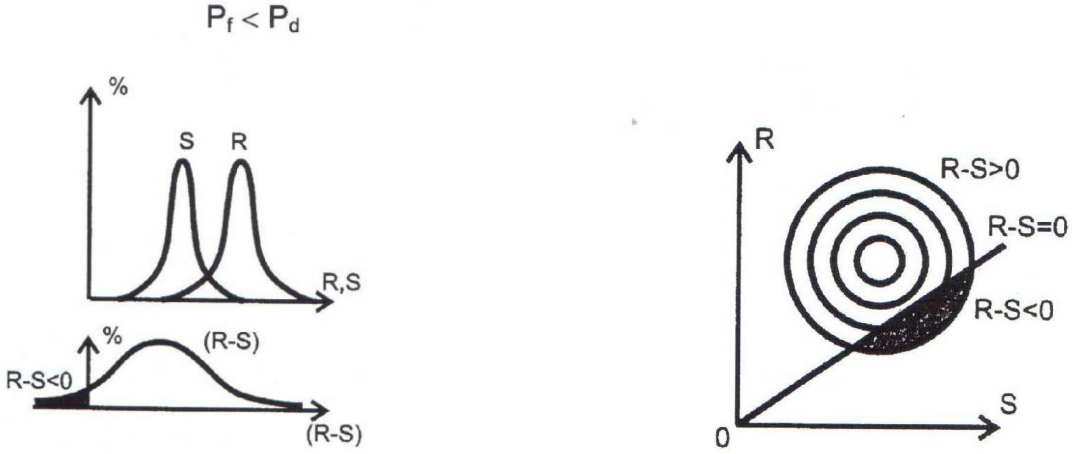

Fig. 1. Reliability assessment outline according to SBRA

Fatigue assessment of a welded detail is involved, embracing the stress spectrum in seven classes. It is considered:

- stress amplitudes in the particular classes with uniform distribution,
- cycle quantities with both normal distribution and coefficient of variation $v\,[n] = 0.05$,
- trilinear life curve with the constant exponents 3 and 5; its variability is determined by standard deviation $s\,[\log N] = 0.18$,
- limiting damage with log – normal distribution, median equal to 1, and coefficient of variation $v\,[D_M] = 0.3$.

Reliability margin is expressed in the form

$$G = D_M - Z = D_M - b_1 D_b$$

and D_M is limiting damage, Z is accumulated damage

$$Z = b_1 D_b ,$$

where b_1 is number of operation weeks, D_b is accumulated fatigue damage / per one week.

In the reliability condition being due to the fatigue limit state, in the treatise, the advantages of simulation methods, above all are analyzed and pointed in an exemplary fashion to, it is possible to apply the empirical distributions – histograms even the truncated random quantities distributions. For the purpose of bridge construction assessment methodology factors of both loading effects and resistance are analyzed in detail.

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